

# Assessing Market Potential of Agroforestry Tree Seedlings in Western Kenya

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**Abstract** In this study, Porter's framework is used to analyse the forces that coordinate and control the market for agroforestry tree seedlings in the Nyando basin in Western Kenya where smallholder farmers were assisted by non-governmental and research organisations to start tree seedling nurseries, with a view to fostering adoption of agroforestry in the region. In addition, financial viability of the enterprise is assessed and the resources and interventions required to improve the operators' competitiveness and make the enterprise sustainable are identified. Primary data collected from eight nursery operators and sixty agroforestry farmers are used and supplemented with secondary information obtained from relevant literature to gain an insight into the tree seedling industry within and outside the region. The results indicate that the tree seedling industry is highly competitive and is characterised by several small-scale operators who employ similar strategies and produce and sell nearly homogenous products. Consequently, competition is based on price rather than on strategies that require capital investments such as branding, product differentiation and product promotion. The enterprise is financially viable but the gross margins, particularly those of timber tree seedlings, are sensitive to low seedling prices suggesting that competitors are exerting pressure on prices and profitability. Thus, to gain an edge over the competitors, the small-scale operators need to build competitive advantage by adopting strategies that allow them to charge higher prices for their products, maintain customer brand loyalty and understand the coordination, control and relationships within the industry.

**Keywords** Market potential · Porter's framework · Agroforestry · Tree seedlings · Kenya

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## Introduction

Well-functioning markets play an important role in expediting the process of agricultural development through enhanced uptake of improved technologies. This is because when markets function well, trade thrives and farmers are able to recoup returns on investment outlays, thus providing an incentive for reinvestment in agriculture (Jayne et al. 2004). However, there is overwhelming evidence that the majority of smallholder producers in developing countries tend to focus on production without paying regard to knowing where to sell their products because of market failures (Poulton et al. 2006; Ashraf et al. 2008). Consequently, they generally do not have a strategy on how to market their goods and hence cannot compete effectively with the large-scale producers. Yet, many pro-poor value chain interventions geared towards upgrading the chain and improving the livelihoods of smallholder farmers tend to overlook the need for market feasibility studies despite the crucial role of such studies in providing information on market potential and viability of the enterprises embedded in such interventions.<sup>1</sup> Moreover, with the advent of emerging markets for agricultural and food products in sub-Saharan Africa, such as those of speciality products and hence new market segments owing to changes in buyer preferences (Jaffee 1994; Delgado 1999; Weatherspoon and Reardon 2003; Tschirley 2007), producers need evidence-based guidance to engage in demand-driven production and targeted marketing.

Market analysis makes targeted marketing possible because it enables producers to identify a set of customers with clearly defined preferences for a specific set of attributes and a marketing channel to deliver their products. In addition, market analysis seeks to find ways of enabling the producers to have competitive advantage at the point of sale by improving quality, product differentiation, market segmentation and development of specific client niches. Likewise, Arnold and Dewees (1998) underscore the need for a much broader approach to extension in which extension agents are able to provide access to market information and help in marketing so that producers are presented with a menu of options reflecting the widely varying requirements for specific tree products and services. Consequently, market analysis provides extension specialists with information on market potential and enterprise viability to facilitate adoption of demand-driven technologies.

This study is an attempt to illustrate the importance of market feasibility analysis using tree seedling enterprise as a case study. The tree seedling enterprise, which is now a popular income generating activity among smallholder farmers in the Nyando basin, was implemented by the Kenya Agricultural Research Institute (KARI) to foster tree planting in the region, with a view to stopping gully formation and reducing land degradation. The introduction of the tree seedling enterprise was based on the premise that availability of germplasm is a crucial element of scaling up agroforestry in the region. As a result, non-governmental organisations (NGOs) and national (KARI) and international (World agroforestry Centre-ICRAF) research institutions, which were the main collaborators in the

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<sup>1</sup> (Jandil 2008) is one such study that attempts to simulate the ex ante impact of subsidy on the adoption of agroforestry practices in Western Kenya, but pays limited attention to the demand side of the equation.

project, continued to play a major role in facilitating the acquisition of superior germplasm by the small scale operators and farmers in a bid to hasten adoption of agroforestry. However, there have been concerns that the market for tree seedlings in the intervention sites is distorted because the industry is still dominated by the charitable NGOs that provide free support services such as technical advice and market information as well as free inputs to nursery operators while at the same time purchasing the seedlings and distributing them for free to the farmers.

The objectives of this paper are (1) to analyse the forces that coordinate and control the market for agroforestry tree seedlings in the Nyando basin and identify resources and interventions that are required to improve the small scale nursery operators' competitiveness and make the enterprise sustainable and (2) assess the viability of the tree seedling enterprise using data from five preferred tree species namely *Grevillea robusta*, *Eucalyptus spp.*, *Casuarina equisetifolia*, *Mangifera indica* and *Carica papaya*. The findings of this study will be used by participants in the tree seedling industry to develop successful strategies to influence the market forces for their own benefit and hence develop a financially viable and sustainable enterprise.

The paper proceeds as follows: section two provides a brief overview of the methodology and analytical framework adopted in this study. The findings are presented and discussed in section three whereas conclusion and policy implications are presented in section four.

## Methodology

### Analysis of Forces Coordinating the Tree Seedling Industry

Analysis of the competitiveness of the tree seedling industry draws heavily from the model of the Five Competitive Forces developed by Michael Porter in 1980. Porter's framework focuses on five areas of competition in the marketplace that determine the intensity of competition and hence the profitability and attractiveness of an industry. The five forces include threat of new entrants, the bargaining power of suppliers and buyers, threat of substitute products and services, and rivalry among existing firms (Porter 1980). Porter's framework is based on the premise that a firm's strategy should meet the opportunities and threats in its external environment. Thus, an industry's competitive strategy should be based on the understanding of its structures and how they change over time. Consequently, such analysis should go beyond the traditional SWOT (Strengths, weakness, opportunities and threats) analysis. Based on the information obtained from the analysis of the five forces, market actors can develop strategies to influence or exploit particular characteristics of their industry.

Although Porter's model has gained popularity in the business industry, it is increasingly being applied to analyse forces that affect competition in the markets for agricultural and agroforestry products (Gold et al. 2003). While Porter's model focussed on the five forces, a number of studies such as Gold et al. (2003) underscore the importance of policy as a sixth force in the analysis of market

potential. Policy plays a critical role in determining the way the five forces shape a given industry. Indeed, there is empirical evidence that widespread adoption of agroforestry, which is a major driver of the tree seedling industry, is strongly influenced by the policy and institutional context in which agroforestry is disseminated (Ajayi and Place 2012).

### Data and Empirical Analysis

To identify forces within the market for agroforestry tree seedlings in the Nyando basin and obtain data for the estimation of gross margins for the enterprise, a three-step research methodology was adopted.

The first stage entailed a review of past literature from Technoserve and ICRAF (2002), Muriuki (2005), Khaguli (2007) and Graudal and Lillesø (2007) to validate information obtained from the key informant and individual interviews and gather more information on the distribution and marketing of tree seeds and seedlings within and outside the study area.

Second, a stakeholders' workshop was organised in Kisumu and three stakeholders' forums held in Onyuongo, Katuk-Kapsiti and Kapsokale micro-catchments where the interventions were implemented. The objectives of the two workshops were to identify relevant chain actors and the functions they perform, identify tree species preferred by the actors and develop generic value chains for further validation through key informant and semi-structured interviews. Participants in the stakeholders' workshop were drawn from research organisations (ICRAF and KARI), public and private providers of rural advisory services like the Ministry of Agriculture and the Kenya Forestry Services (KFS) and NGOs (SSC-Vi Agroforestry, CARE- Kenya, and World Neighbours) and Community Based Organisations (CBOs), respectively. The stakeholder forums comprised key actors in the agroforestry supply chain such as small scale seed vendors and nursery operators, agroforestry farmers (producers), traders of fuel wood, timber and fruits and primary processors such as carpenters and charcoal burners.

In the third stage, checklists and semi-structured questionnaires were developed and administered to 8 small scale nursery operators and 60 farmers. Snowballing approach was used to sample respondents because sample frames of operators and farmers were not available. The questionnaires and checklists sought information on the tree species preferred by the value chain actors, the cost of producing and marketing seedlings of the preferred tree species, and market outlets where the nursery operators buy and sell tree seeds and seedlings, respectively. In addition, information was obtained on access to business services, such as transport, credit, inputs, market information, technical advice, as well as on enabling environment for the production and marketing of tree seedlings.

### Assessment of Viability of the Tree Seedling Enterprise

The assessment focused on financial rather than economic viability and aimed at examining whether the tree seedling enterprise was able to generate financial gains to the nursery operators rather than to the economy in general. Gross margins were

estimated for the five tree species and used as proxies for financial viability instead of net returns to variable and fixed costs.<sup>2</sup> Variable costs such as those of seeds, hired labour, potting media, water and pesticides as well as marketing costs were considered in the estimation of gross margins. Most of the variable costs were imputed costs from non-cash expenses such as manure, soil, water and seeds because a number of nursery operators either collected seeds or seedlings from existing mother blocks on their farms or received seeds for free from the NGOs and research institutions. Imputed cost of family labour, although generally considered as a fixed cost, was included in the estimation of gross margins because nearly all the nursery operators interviewed used limited amounts of hired labour. As such, excluding family labour and other implicit costs such as owned transport would grossly overestimate the viability of the enterprise. Prevailing prices of owned inputs reported by the operators who purchased such inputs were used to estimate their opportunity cost.

Because the NGOs were reported to provide inputs such as farm tools and seeds to the nursery operators and later purchase seedlings from the operators at reduced prices, the buyers of tree seedlings were separated into three categories namely, farmers, NGOs and institutions and the gross margins computed across these channels.<sup>3</sup> The average prevailing seedling prices reported by the nursery operators for the different categories of buyers was used to estimate the returns. In addition, the sensitivity of the enterprise to changes in output prices were tested by estimating gross margins at the lowest and the highest prices offered by the buyers.

## Results and Discussion

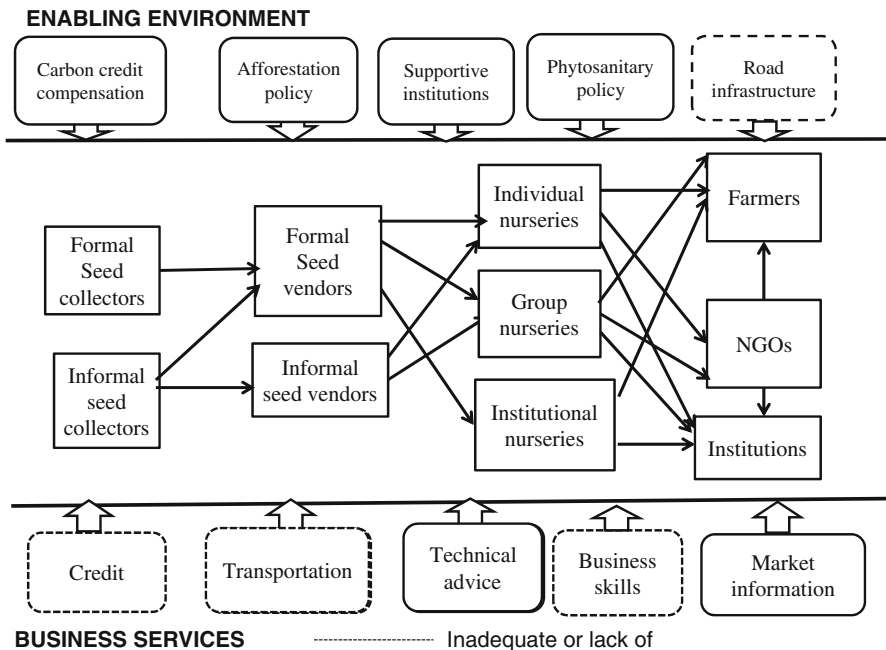
### Characteristics of the Tree Seedling Industry

Figure 1 shows actors in the tree seedling supply chain as well as the functions they perform and the business services available to the nursery operators.<sup>4</sup> The tree seedling industry consists of seed collectors, seed vendors, nursery operators and producers (agroforestry farmers). In the region, seed collectors are mainly smallholder farmers who comprise two categories namely, formal and informal collectors. Formal collectors are farmers who have been trained on seed selection and authenticated to sell seeds to seed vendors. However, owing to the liberalisation of the seed market, some unlicensed (informal) seed collectors form part of the

<sup>2</sup> The gross margins do not imply profitability since the computation of profitability requires inclusion of fixed costs such as those of land, establishing nursery shade, depreciation cost of the nursery shade and farm tools. Nevertheless, the estimated gross margins should provide an insight into the most feasible channel that the operators should explore holding constant fixed costs.

<sup>3</sup> NGO 's and Institution's channels herein refer to sale of tree seedlings by nursery operators to NGOs, such as CARE Kenya and SSC-Vi Agroforestry, and government institutions such as the Ministry of Agriculture and schools, respectively.

<sup>4</sup> To the extent that the tree seedling enterprise is a recent business venture in the Nyando basin, the sampled operators were drawn from those who were participating in the project under donor-driven market conditions. Consequently, the findings presented on nursery operators might not adequately reflect those confronted by seedling producers operating in a market driven environment.



**Fig. 1** Tree seedling supply chain in Nyando Basin

supply chain. A few large scale formal seed collectors, mainly the Kenya Forestry Research Institute (KEFRI) through its Kenya Forestry Seed Centre (KFSC) have orchards where they collect seeds and sell to small scale seed vendors country wide.

Seed vendors, particularly those of timber tree species, comprise both formal and informal channels. The formal channel consists of institutional based vendors such as KSFC and small scale seed vendors who have been trained by research organisations on seed selection and multiplication and are registered with KEFRI. Other institutional-based seed vendors that distribute seeds to the operators for demonstration include research institutions such as KARI and ICRAF as indicated in Table 1. The informal seed vendors, on the other hand, consist of small scale farmers who may or may not have been trained by research organisations and NGOs, but have not yet been registered by KEFRI. In some cases, the NGOs such as CARE-Kenya, SSC-Vi Agroforestry and World Neighbours among others act as informal seed vendors and provide small scale nursery operators with free seeds to foster tree planting and initiate income generating activities for the smallholder farmers.

The informal seed vendors appear to have competitive advantage over the established institutions because of their close proximity to the buyers. This is consistent with our findings that only a few operators purchase seeds specifically from small scale operators while nearly all the operators obtain seeds from their own mother blocks. Indeed, the established government institutions have been shown to transact more with large scale nursery operators than with small scale operators who

**Table 1** Sources of tree seeds reported by the eight nursery operators

	Purchased	Free from NGOs	Free from research institutions	Self-collection
Grevillea ( <i>n</i> = 8)	0	3	1	4
Casuarina ( <i>n</i> = 5)	1	1	2	1
Eucalyptus ( <i>n</i> = 5)	0	0	0	5
Mango ( <i>n</i> = 2)	0	0	0	2
Pawpaw ( <i>n</i> = 4)	2	0	0	2

rely on informal sources (Muriuki 2005). Fruit tree seeds, particularly those of Mango and Pawpaw are obtained from mother blocks or collected from nearby markets, but the seedlings are rarely grafted because the operators lack the specialised skills.

Three types of nursery operators exist in the Nyando basin, namely individual, communal (group) and institutional nurseries. Individual nurseries are the most common in the region and are operated by small scale farmers who may or may not have been trained by the research institutions and NGOs. On the other hand, some nursery operators could be government employees or employees of the NGOs who trained in Forestry at Bachelor's or Diploma level and currently operate the tree seedling nursery as a business. Group nurseries were mainly started by the NGOs and research organisations to exploit the benefits of collective action and achieve wide scale adoption of agroforestry in the region. Institutional-based nurseries that serve the region include KEFRI in Maseno, KARI in Kibos and ICRAF in Kisumu. The majority of small scale operators rely on owned resources such as self-produced seeds, manure and family labour to produce seedlings. Own seed collection accounts for the largest share of seeds planted by the nursery operators as in the case of Mango and Eucalyptus as shown in Table 1. Purchased inputs such as superior quality seeds of *Grevillea* and *Casuarina* and modern materials for establishing nursery shade and polythene tubes are provided by the NGOs for free as start-up capital and an incentive to engage in the tree seedling business. In addition, the NGOs provide support services such as technical advice, market information, and training on seed and seedling selection and production.

The tree seedlings raised by more than a third of the sampled nursery operators in a ranked order include *Grevillea robusta*, *Eucalyptus spp.*, *Casuarina equisetifolia*, *Carica papaya*, *Mangifera indica*, *Markhamia lutea* and *Gliricidia sepium*. *Grevillea robusta* is the most preferred tree species and is raised by all the sampled operators. On balance, the operators prefer exotic to indigenous tree species because of the existing demand for exotic species.

Most of the sampled operators perform more than one function along the chain such as seed collection, seed vending and agroforestry farming, suggesting that there is the tendency for the operators to integrate backward and forward along the chain. While a few group nurseries exist, individual production and marketing of tree seedlings appears to be more common than collective action. Yet collective action in tree nursery enterprises has been shown to facilitate the operators' access

to niche markets such as those of high quality germplasm and enhance their competitiveness (Catacutan et al. 2008). Likewise, transactions take place in the spot market as opposed to contractual arrangements, thus indicating the absence of close relations between the buyers and the sellers.

The findings indicate that there are three types of buyers of tree seedlings, namely farmers, the NGOs and institutions such as schools, the Ministry of Agriculture and hospitals. Like the nursery operators, farmers rely on owned resources such as planting materials, while superior quality germplasm used by the farmers is obtained from the NGOs who buy the seedlings from designated nursery operators and distribute them to selected producers for free. In cases where the seedlings are not sufficient, the producers supplement with their own seedlings, which they raise on their farms using owned or purchased seed and occasionally purchase small quantities from private operators.

In general, the farmers plant both exotic and indigenous tree species, but the majority of the sampled farmers prefer exotic to indigenous tree species. Exotic species preferred by the farmers in a ranked order include *Grevillea robusta* (97 %), *Eucalyptus spp.* (78 %) and *Casuarina equisetifolia* (58 %). However, the farmers generally grow and/or manage indigenous species such as *Markhamia lutea* and *Terminalia brownii*. The majority of sampled producers have between 10 and 50 trees of each species on their farms, suggesting that the farmers operate small scale production systems. In general, the sampled producers tend to plant more of timber tree species such as *Grevillea*, *Eucalyptus* and *Casuarina* than fruit tree species like Mango and Pawpaw. Most of the transactions take place on the spot market and contractual arrangements between buyers and sellers are virtually absent. Like the nursery operators, the farmers perform more than one function along the chain such as seed collection, seed vending, and seedling production.

Table 2 suggests that farmers are the main buyers of tree seedlings of the five tree species while NGOs buy seedlings of *Grevillea* and *Casuarina* only. Further, the data indicate that among the three channels for *Grevillea* and *Casuarina*, NGOs buy larger quantities of seedlings compared to individual farmers and institutions.

Business services identified by operators as critical for the production and marketing of tree seedlings include credit facilities, rural advisory services, market information, and transport services. However, the data suggest that the operators have limited access to most of the services. For instance, none of the eight operators had access to credit. Likewise, only three of the operators reported to have had access to technical advice, which was mostly obtained from the NGOs. The operators were found to view the tree seedling enterprise as a pastime rather than an income generating activity, indicating that entrepreneurial skills could be lacking, yet the operators need such skills to be able to compete effectively in the tree seedling industry. The operators rely on the NGOs for market information although some of them depend on the buyers to provide them with information about the tree species on demand as well as the prevailing prices. Thus, it appears that the operators are vulnerable and hence liable to exploitation in case of information asymmetry. Road network linking the micro catchments with major towns is generally poor, which could reduce profit margins due to the high cost of transportation. In addition, poor road network limits the operators' interaction with



**Table 2** Proportion of tree seedlings sold and number of nursery operators selling to various buyers

	Farmers		NGOs		Institutions	
	No. selling	Sales (%)	No. selling	Sales (%)	No. selling	Sales (%)
<i>Grevillea</i> ( $n = 8$ )	8	33	2	51	1	15
<i>Casuarina</i> ( $n = 5$ )	5	19	2	51	3	30
<i>Eucalyptus</i> ( $n = 5$ )	5	54	0	0	2	46
Mango ( $n = 2$ )	2	100	0	0	0	0
Pawpaw ( $n = 4$ )	4	100	0	0	0	0

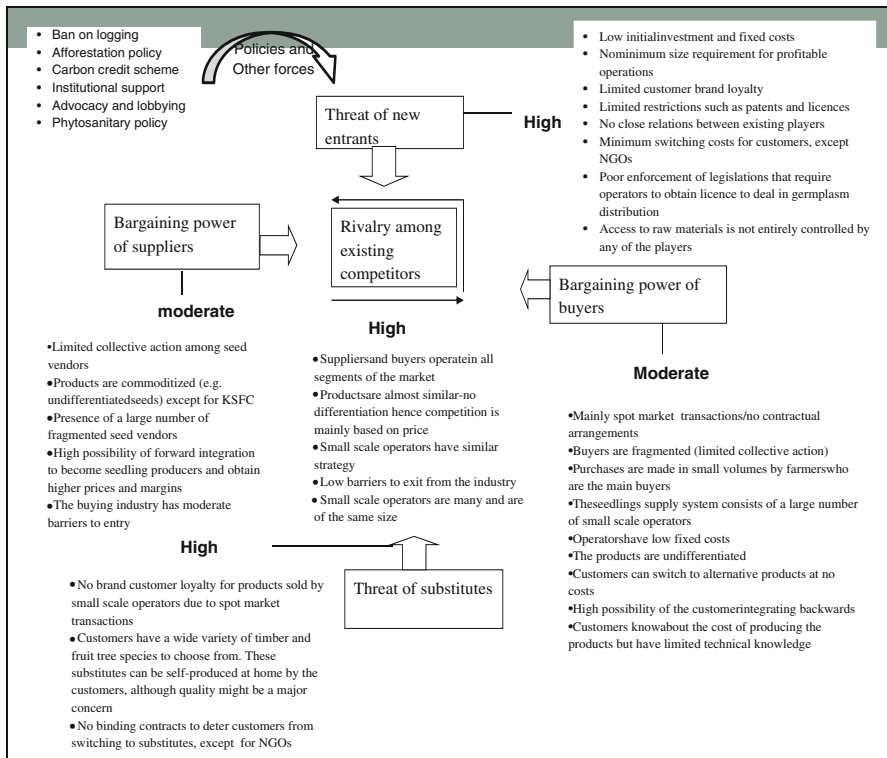
other chain actors and reduces their chances of accessing alternative buyers, thereby weakening their bargaining power.

### Forces Coordinating the Tree Seedling Industry

#### *Bargaining Power of Suppliers*

The findings of the analysis of the six forces coordinating the tree seedling industry are summarised in Fig. 2. The bargaining power of the suppliers (seed vendors) is found to be moderate because, with the exception of one large and established seed vendor (KFSC), the market for tree seeds is dominated by a number of fragmented seed vendors that sell seeds of varying qualities. While the KFSC has a long standing reputation for producing superior seeds and enjoys the monopoly of selling to customers who value quality, other institutions such as ICRAF and NGOs that advocate for the decentralisation of the tree seedling system have trained farmers on seed selection. Nevertheless, the small scale seed vendors have to register with KEFRI, which operates the tree seed unit, suggesting that KFSC could be having competitive advantage over the small scale vendors. However, following liberalisation of the seed sector, the small scale seed vendors are able to sell seeds without any licence, thus reducing the competitive advantage that the KFSC has over them. Besides, the small scale seed vendors are able to reach the farmers in the periphery unlike the KFSC, which operates only in a few regional centres in the country. However, the quality of the seeds produced by the unregistered vendors is considered to be inferior to those obtained from authorised suppliers because the training offered to small scale vendors is reported to focus on physiological and not genetic qualities as well (Muriuki 2005).

While there are limited substitutes for certified tree seeds of specific tree species owing to the limited number of registered vendors, the operators who have been trained on seed production have alternative sources of accessing good quality seeds, particularly from mother blocks. This is particularly true for tree species such as *Eucalyptus*, Mango and Pawpaw. However, seeds of some tree species such as *Grevillea robusta* are unavailable or difficult to harvest from the mother trees. Currently, the NGOs and research institutions are seen to bridge the gap by providing the operators with certified seeds of *Grevillea* and *Casuarina* for free.



**Fig. 2** Summary of the forces coordinating the tree seedling industry in Nyando basin

However, there are concerns about the sustainability of this mode of acquisition, because the involvement of the NGOs in the supply of seeds has been reported to hinder the emergence and development of sustainable supply chain (Arnold and Dewees 1998; Graudal and Lillesø 2007).

In general, the products produced by the suppliers are commoditised and competition is based on certified versus non-certified seeds. Consequently, there is limited differentiation of the products and where such efforts exist; the majority of the buyers are not able to discriminate among the products because of limited knowledge or inadequate access to capital. Furthermore, the small scale seed vendors are fragmented and operate individually rather than collectively, thus lowering their bargaining power. The suppliers are found to be more likely to integrate forward to obtain higher prices and margins owing to limited barriers to entry into the industry.

The buyers are found to have some barriers to entry into the seed vending industry because the production of certified seeds requires specialised skills and laboratory equipment to examine both physiological and genetic qualities. In addition, seed vendors need to register with KEFRI to be recognised as formal seed vendors. However, the barriers are considered to be moderate because vendors are

able to operate without a licence owing to the liberalisation of the seed market and weak enforcement of policies.

### *Bargaining Power of Customers*

The results suggest that the customers have varying degrees of bargaining power depending on the type of buyer. Small scale farmers, who are the main buyers of tree seedlings such as Mango, Eucalyptus and Pawpaw, purchase small quantities of seedlings. However, the NGOs buy large quantities of seedlings of *Grevillea* and *Casuarina* at lower prices than those offered by farmers. For example, farmers purchase between 300 and 3,600 seedlings compared to NGOs who buy between 1,500 and 2,500 seedlings of *Grevillea* while institutions purchase about 600 seedlings. On average, the operators sell one seedling of *Grevillea* to farmers and NGOs at KES 10 and 7 respectively. Thus, it appears that operators have limited bargaining power when dealing with the NGOs because the NGOs control the supply of vital inputs and hence are able to negotiate for lower prices. Alternatively, the operators could be selling to the NGOs despite the low prices because of reliability and hence lower marketing risks. The greatest challenge, however, lies in the sustainability of the arrangement as noted by (Graudal and Lillesø 2007) that markets are generally distorted by the distribution of free seeds and seedlings of inferior quality from NGOs and donors through development projects.

The data indicate that customers are able to produce most of the seedlings by themselves, although the quality may not be the same as those obtained from registered operators because the majority of the farmers lack specialised skills and the experience required to produce such seedlings. On average, 65 % of the farmers were found to produce their own seedlings and about 65 % purchased seedlings mainly to supplement the deficit. However, self-production of seedlings appeared to be predominant among farmers producing Pawpaw, *Casuarina* and *Eucalyptus* than those producing *Grevillea* and Mango. While the majority of the farmers (50 %) producing Pawpaw relied on self-production, farmers producing *Grevillea* and *Casuarina* supplemented the largest proportion of the deficit with free seedlings obtained from the NGOs and research institutions.

Fixed costs of the supplying industry are generally low, suggesting that asset fixity is not a major barrier for the suppliers who may want to switch to other enterprises. Start-up capital required for a small scale tree seedling nursery is found to be minimal as most of the inputs such as seed can be collected or recycled like used packets of milk or pots. Similarly, most of the farm equipment such as wheelbarrows, watering cans and shade netting are not very critical for small scale nursery and can be improvised if needed. To the extent that the tree seedling industry consists of several small scale operators, customers have a wide range of suppliers to buy from and hence have high bargaining power over the suppliers. Likewise, the findings reveal that buyers could be exerting higher bargaining power over the suppliers because they can easily switch to other enterprises since agroforestry is not of strategic importance to them. The long duration that it takes to recuperate investment outlays from agroforestry enterprise coupled with limited

knowledge of the long term benefits of trees makes the enterprise less attractive to the buyers.

Most of the products sold by the operators are undifferentiated and can be easily replaced by substitutes, thus reducing the suppliers' bargaining power. However, differentiation by quality is possible but the production of superior quality germplasm requires specialised techniques such as grafting skills. The results suggest that the buyers are more likely to find substitutes for tree seedlings of Eucalyptus and local Mango variety, but seedlings of Grevillea and those of improved Mango and Pawpaw varieties have to be purchased from registered suppliers. In this case, the registered operators may exert high bargaining power over the buyers because of limited availability of substitutes.

The results indicate that customers are aware of the resources needed to produce the seedlings but lack of entrepreneurial skills coupled with the specialised skills required to produce superior quality germplasm diminishes their bargaining power. Likewise, the customers have the potential to integrate backwards to control the chain because the production of own germplasm assures them of increased incomes and reliable sources of germplasm. Yet, they are less likely to exploit this potential fully because they have inadequate access to market information, limited entrepreneurial skills and limited technical knowledge.

#### *Threat of New Entrants and Substitutes*

In general, the tree seedling industry is characterised by high threat of new entrants and substitutes. The findings suggest that there are limited barriers to entry into the seedling industry, thus allowing competitors to enter the industry and change the major determinants of the market environment such as market share, prices and customer loyalty. For instance, starting a small scale tree seedling enterprise does not require economies of scale as there is no minimum size required for a profitable tree seedling nursery. This is corroborated by the presence of a large number of peri-urban nurseries that were found to thrive by the road sides in major towns such as Kisumu and Nairobi by Kindt et al. (2006). The business is more attractive to competitors because it does not have high initial investment and fixed costs and yet the tree seedlings can grow fast and give immediate returns. Likewise, a few players such as KEFRI that enjoy cost advantages because of long standing experience in the industry exert minimum barriers to entry into the industry for small scale operators because they are located farther away from the buyers as compared to the small scale operators.

Customer brand loyalty for the products produced by small scale operators is generally low because the transactions between the buyers and the suppliers take place on the spot market. Consequently, existing players do not have close relations with the customers because contractual arrangements that nurture longstanding relationships among the actors are virtually absent. Likewise, customers are confronted with low switching costs owing to lack of legally binding contracts and customer brand loyalty. Moreover, availability of substitutes and alternative sources of the seedlings reduces the customers' brand loyalty and lowers switching costs for customers. Similarly, the relative prices of substitutes do not differ markedly, thus

allowing buyers to switch to other tree species when prices of seedlings of the preferred species increase. Although *Grevillea* is the most preferred tree species among the buyers, farmers interested in planting timber tree species can easily substitute *Grevillea* with *Eucalyptus*. Whereas barriers to entry in the tree seedling industry seem to be generally low, barriers to entry in the production of fruit tree seedlings appear to be relatively high. For example, the production of high quality fruit tree seedlings requires sufficient capital and specialised skills because the seedlings are susceptible to pests and diseases and require grafting to shorten maturity period. Pests and diseases reduce profit margins and increase risks and uncertainty about the enterprise, thus making it less attractive for small scale operators who might want to venture into the business.

Other factors that contribute to low barriers to entry in the industry include lack of protected intellectual property rights such as patents and licences. While the nursery operators and seed vendors are required to register with KEFRI for certification, poor enforcement of such policies make it easier for competitors to join the industry provided they have the capital and skills required to start-up the business. In addition, none of the small scale operators controls access to raw materials required to produce seedlings.

#### *Rivalry Among Existing Competitors*

The tree seedling industry exhibits high intensity of competition between existing players because of low barriers to entry and availability of substitutes. Consequently, the industry is characterised by many small scale nursery operators of about the same size who employ similar strategies and produce and sell nearly homogenous products. Competition is mainly based on price and use of strategies that require capital investment, such as product promotion, product differentiation, and absolute cost advantage, is limited. However, the aforementioned strategies are employed by established competitors such as KEFRI. Yet, the established competitors are few and can only reach a small segment of the customers. Because the players compete on the basis of prices, they do not enjoy abnormal profits and growth is only possible at the expense of another competitor. Likewise, high rivalry is attributed to low barriers to exit from the industry since the small scale tree seedling enterprise does not require specialised equipment and has low investments and fixed costs. Therefore, competitors can join or leave the industry whenever it is deemed profitable or unprofitable.

#### *Policies and Other Forces Coordinating the Tree Seedling Industry*

Other market forces, which may act as barriers to entry or open doors for new markets and hence influence the extent to which the five forces shape the tree seedling industry, were identified. Such forces include government ban on logging, sensitization of the customers on environmental conservation, carbon credit compensation scheme, afforestation policy, and scarcity of forest products due to depletion of natural forests. A ban on logging often motivated by the need to prevent illegal felling of trees from natural forests is likely to compel the farmers to plant

trees on-farm to be able to meet the demand for fuelwood and construction materials. This is likely to stimulate the demand for tree seedlings of the preferred tree species such as *Grevillea* because the ban may reduce the supply of substitute products. On the other hand, a ban on logging could discourage tree planting as observed by Arnold and Dewees (1998) and Yonariza (2010). These studies found that where cutting, transporting and marketing of tree products is subject to government regulations, smallholder farmers tend to be reluctant to plant trees on their farms because of the bureaucracy involved in acquiring permits and the distortion of market forces resulting from the ban.

The presence of NGOs and research organisations that sensitize the buyers on the benefits of planting trees is likely to raise the demand for tree seedlings. On the other hand, the government and NGOs discourage planting of *Eucalyptus* because of its perceived adverse effects on adjacent crops and on depleting the water table. Their actions could reduce the threat of substitutes and alter the nature of competition in the industry particularly for seedlings of tree species that are deemed to have environmental benefits such as *Grevillea*, *Casuarina*, *Mango* and *Pawpaw*. Alternatively, because the seedling industry has low switching costs for buyers, some farmers may switch from *Eucalyptus* to other enterprises such as crop production that are deemed profitable.

Carbon credit compensation and payment for ecosystem services (PES), which are currently being implemented in the Nyando basin by institutions such as CARE-Kenya and ICRAF respectively, are likely to encourage tree planting and raise the demand for tree seedlings. This proposition is borne out by other studies which show that PES have been used to encourage farmers in Africa to invest in agroforestry and in the protection of existing forests (Jandil et al. 2006).

Depletion of natural forests, on the one hand, and the increase in demand for forest products such as timber for furniture, construction materials, and fuelwood on the other, is likely to compel farmers in the region to plant trees on their farm to cash in on the high demand. This is likely to increase the demand for seedlings of fast growing species such as *Grevillea* owing to the limited number of low cost substitutes from natural forests. This view is reinforced by Scherr (1995) and Arnold and Dewees (1998)'s findings that the density of planted trees increases as agriculture intensifies and access to forests and woodlands decreases.

The 10 % forest cover policy, which is currently being implemented in Kenya if accompanied by appropriate enforcement mechanisms might foster the culture of tree planting among the people living in the Nyando basin, thus opening up other markets and raising the demand for tree seedlings.

### Financial Viability of the Tree Seedling Enterprise

The data presented in Table 3 indicate that nursery operators are able to earn positive gross margins, particularly if the operators target individual farmers as customers. Further, the results show that fruit tree seedlings such as *Mango* and *Pawpaw* have higher gross margins than timber tree seedlings like *Grevillea*, *Eucalyptus* and *Casuarina*. Likewise, *Pawpaw* seedlings provide the highest gross margins of about KES 25 per seedling among the fruit tree seedlings while *Grevillea*

**Table 3** Gross margins per seedling for the tree seedling enterprise

Description	Grevillea (n = 8)	Casuarina (n = 5)	Eucalyptus (n = 5)	Mango (n = 1)	Pawpaw (n = 4)
<b>Production cost</b>					
Germplasm	1.20	1.20	1.10	1.70	0.80
Labour	2.45	2.80	1.82	3.35	2.50
Water	0.09	0.10	0.07	0.16	0.10
Potting media <sup>a</sup>	0.30	0.31	0.40	0.33	0.55
Polythene tube	0.70	0.74	0.60	0.65	0.70
Pesticide	0.05	0.06	0.04	0.09	0.10
Total production costs	4.90	5.30	4.10	6.40	4.90
Marketing costs	0.30	0.10	0.13	0.80	0.16
Total cost	5.20	5.40	4.23	7.20	5.06
<b>Selling price</b>					
Average price	10.00	8.20	9.00	20.00	30.00
Lowest price	5.00	5.00	5.00	20.00	10.00
Highest price	15.00	10.00	10.00	20.00	50.00
Farmer channel	10.00	7.50	9.00	20.00	30.00
NGOs' channel	7.00	7.00	—	—	—
Institutional channel	5.00	8.30	7.50	—	—
<b>Gross margin</b>					
Average	4.80	2.80	4.80	12.80	25.00
Lowest	-0.20	-0.40	0.77	12.80	4.94
Highest	9.80	4.60	5.77	12.80	20.00
Farmers' channel	4.80	2.10	4.77	12.80	25.00
NGOs channel	1.80	1.60	—	—	—
Institutions' channel	-0.20	2.90	3.27	—	—

<sup>a</sup> A mixture of sand, soil and manure

Costs, selling prices and gross margins are in KES per seedling

and Eucalyptus have the highest gross margins of KES 4.80 per seedling among the timber tree seedlings. Nevertheless, the gross margins appear to be highly sensitive to low seedling prices, suggesting that inclusion of fixed costs could make the enterprise less attractive, particularly for the timber tree seedlings. At very low prices of about KES 5, nursery operators are not able to cover variable costs as well as the returns to family labour as indicated by the negative gross margins. Low gross margins such as those of the timber tree seedlings is an indication of a competitive market and suggest that competitors are exerting pressure on prices and profitability.

Fruit tree seedlings fetch higher prices than timber tree seedlings because they are highly susceptible to diseases and pests. Consequently, the relatively high costs and risks associated with raising fruit tree seedlings act as barriers to entry for many competitors who would have liked to venture into the fruit tree seedling industry. In addition, there appears to be minimum price distortions in the fruit tree seedling industry because of the limited involvement of the NGOs in the purchase and

distribution of fruit tree seedlings to farmers. Thus, the data suggest that the nursery operators are better off investing in the fruit tree seedling industry. Nevertheless, the decision as to the type of fruit tree seedling to invest in depends on the competitiveness of the industry, which in turn determines the expected returns as well as availability of buyers. The findings indicate that Pawpaw seedlings are the third most frequently sold tree species after *Grevillea* and *Eucalyptus*, suggesting that nursery operators may be reluctant to invest in the enterprise even if the returns are high.

The gross margins estimated for the three market channels suggest that nursery operators are able to cover variable costs including returns to family labour if they sold seedlings through any of the three channels with the exception of *Grevillea* seedlings sold to institutions. A cursory look at gross margins for the three market channels reveals that the margins are higher when the operators sell the seedlings to farmers than when they sell to the NGOs and institutions. However, the greatest challenge faced by the operators that rely on the farmers' channel is its unreliability owing to the small quantities purchased as well as lack of close customer relations between the operators and the farmers. Whereas the NGOs' channel gives relatively lower gross margins compared to the farmers' channel, it appears that it provides a reliable market for the operators through bulk buying and hence has fewer transaction costs and risks.

## Conclusion and Policy Implications

The results reveal that the tree seedling industry is highly competitive as suggested by moderate bargaining power of suppliers and customers, high threat of entrants and substitutes and high rivalry among existing competitors in the industry. The industry is characterised by small scale operators who employ similar strategies and produce and sell nearly homogenous products. Consequently, competition is based on price rather than on strategies that require capital investments such as branding, product differentiation, and product promotion. While a few established government institutions such as KEFRI appear to have competitive advantage over the small scale nursery operators in terms of customer brand loyalty, the small scale operators' close proximity to the buyers coupled with the customers' inability to differentiate between the products due to lack of knowledge seem to erode this competitive advantage.

Likewise, with the exception of the NGOs that buy seedlings in bulk and distribute them to farmers for free, the main buyers are small scale farmers who purchase seedlings in small quantities. The gross margins indicate that nursery operators are able to cover their variable costs for all the five tree species, particularly if the operators target farmers as the main customers. While the NGOs channel predominates among the buyers of timber tree seedlings, because they buy large quantities of the seedlings, it provides lower gross margins than that of the farmers' channel irrespective of the tree species. Thus, there appears to be opportunities for growth in the tree seedling industry, but the opportunities are less evident because of the involvement of the NGOs in the distribution of inputs and seedlings for free to the suppliers and customers respectively.



While the aforementioned findings need to be corroborated with empirical evidence from further research on the nature of demand for agroforestry tree seedlings under market and donor-driven conditions, some important recommendations emerge from this study. To gain an edge over other competitors in the industry, the small scale nursery operators must build competitive advantages by adopting strategies that allow them to charge more profitable prices for the value offered such as focusing on small market niches like fruit tree seedlings or differentiating the existing products. In addition, the operators need to be trained on specialised techniques such as grafting to be able to maintain customer brand loyalty by providing higher and consistent quality germplasm within the required period. However, the aforementioned intervention needs to be accompanied by sensitization of the customers on the need to use superior quality germplasm as well as linking the operators and the customers to micro-finance institutions to improve their access to credit. Training of the operators on enterprise management skills can improve their understanding of the coordination, control and relationships within the market, thereby enhancing their competitive advantage.

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